REMARKS

Applicant gratefully acknowledges Examiner Rude for taking time on May 3, 2006, from his busy schedule to conduct a personal interview with Applicant's representative to discuss the present Application. During the interview, Applicant's representative brought up a couple of suggestions of features that might expedite prosecution of the present invention.

Specifically, one feature of the present invention is that the contact hole 5 shown in Figure 3 to the source 14 is completely enveloped by the passivation layer 11 covering the transistor 3 to decrease the thickness of the color filter material over the transistor 3. The Examiner stated that he felt that the cited references Zhong/Ohta also included this feature.

The second feature of the present invention is the fine dimension of the contact hole 5, exemplarily given in the specification at lines 11-12 of page 11 as being 5 μm. As indicated at line 19 on page 3 through line 10 on page 5, conventional methods of providing contact holes through color filter material have problems that prevent fine dimensions. The Examiner indicated that such additional limitation might distinguish from the cited references, since small dimension contact holes were known to be a problem through color filter material.

However, the Examiner also indicated that this limitation would require additional search.

Therefore, independent claim 1 is amended and new claim 27 is added to incorporate this feature of the present invention into the claimed invention. No excess claims fee is necessary because of previous claim cancellations and Applicant had previously paid for 6 independent claims and 22 total claims.

Moreover, Applicant adds new arguments below that the modification of primary reference Zhong to include an additional passivation layer PSV1 demonstrates improper hindsight, since the primary reference expressly states as a purpose the reduction in production steps and that the combination of the passivation layer PSV1 of secondary reference Ohta would not provide the present invention, because of its thickness range.

Claims 1, 2, 4-12, 15-18, and 21-27 are all the claims presently pending in the application, with only claims 1, 4, 5, and 24-25 being the subject of the prior art evaluation of

the Office Action dated February 28, 2006. Claims 2, 6-12, 15-18, 21-23, and 26 are withdrawn from consideration as being drawn to a non-elected invention or species and there is currently no allowable generic or linking claim. Applicant maintains that claim 1 is generic to both of the two embodiments, respectively shown in Figure 3 and Figure 6.

The present invention addresses a specific LCD configuration in which the color filter film is used both for forming the color filter and for covering the thin film transistor, the present inventor has recognized that there are two conflicting requirements of the thickness of the color film layer.

First, the layer must be sufficiently thick to form an adequate pixel color filter region. Second, in contrast, as recognized by the present inventor, the layer must also be sufficiently thin for purpose of allowing a fine pattern for the pixel electrode contact hole to be formed. Prior to the present invention, it was not recognized that the thickness of the color film layer had these two conflicting requirements in this LCD configuration.

It is noted that, notwithstanding any claim amendments made herein, Applicant's intent is to encompass equivalents of all claim elements, even if amended herein or later during prosecution.

Claims 1, 4, and 5 stand rejected under 35 U.S.C. § 103(a) as being unpatentable over US Patent 5,994,721 to Zhong et al., further in view of US Patent 6,208,399 to Ohta et al. Claims 24 and 25 stand rejected under 35 U.S.C. § 103(a) as being unpatentable over Zhong/Ohta, further in view of US Patent 6,130,736 to Sasaki et al.

These rejections are traversed in view of the discussion below.

I. THE CLAIMED INVENTION

Applicant's invention, as defined for example in independent claim 1 is directed to an active matrix liquid crystal display device having a first substrate and a second substrate.

At least one of said first substrate and said second substrate is transparent. A plurality of scanning lines is formed on the first substrate. A plurality of signal lines is formed on the first substrate crossing the scanning lines in a matrix manner.

A plurality of thin film transistors is each respectively formed at an intersection of the

scanning lines and the signal lines. Each thin film transistor includes a gate electrode formed on said the substrate, a gate insulation layer formed on the gate electrode, a semiconductor layer formed on the gate insulation layer, a drain electrode formed on a first portion of the semiconductor layer and a first portion of the gate insulation layer, and a source electrode formed on a second portion of the semiconductor layer and a second portion of the gate insulation layer.

A passivation film is formed on the thin film transistors. At least one color filter is formed on the first substrate, wherein a color film forming the at least one color filter additionally covers the passivation film.

A plurality of pixel electrodes is each respectively connected to one of the thin film transistors through a contact hole and each respectively is formed on one of said at least one color filter.

A counter electrode is formed on the second substrate. A liquid crystal layer is formed between the first substrate and the second substrate, the liquid crystal layer being driven by electric fields between the pixel electrodes and the counter electrode to thereby make a display.

The color filter is formed directly on the first substrate in most of a light transmission region by removing the gate insulating layer and the passivation film within a pixel area surrounded by the scanning lines and the signal lines, a thickness of the color film forming the color filter being a preselected first thickness that provides a sufficient chromaticity for the color filter.

The passivation film provides an additional layer over the thin film transistors that reduces a thickness of material of the color filter near the contact hole to a second predetermined thickness chosen to permit a photo-crosslinkage to occur in an entire thickness of the second thickness of the color filter material during an exposure processing for the contact hole.

Thus, it is possible to make a color filter on a contact portion sufficiently thin so that this material can be completely cured for subsequently etching of a fine pattern for the contact via holes, while the color filter on the pixel opening portion remains sufficiently thick to be effective to provide adequate color. In this manner, a high photosensitive color resist can be

used and a fine pattern with small exposure can be formed. Thus, an LCD having good display quality, high precision and a high aperture can be manufactured (e.g. see page 5, lines 13-24; page 11, lines 25-27; page 12, lines 1-2; page 13, lines 9-18; and page 17, lines 1-12).

Essentially, as described beginning at line 13 of page 3 and continuing through line 10 of page 5, the inventor has recognized that the prior art has a number of problems due to the thickness of the color filter material over the TFT and, more specifically, in the drain region having the contact through hole to the pixel electrode. The present invention solves these problems by reducing the thickness of this color filter material in this region by choosing the number and thicknesses of underlying layers to achieve a thickness of overlying color filter material that will cure adequately with short exposure so as to prevent the prior art problems in the drain region that occur due to etching of the via holes.

In an exemplary configuration of the second embodiment, as shown in Figure 5 in which the color material on top of the TFT has a thickness no greater than approximately 0.4 μm, an overcoat layer 19 is added on top of the color filter and provides several benefits, as described on page 16, including that of protecting the color filter and acting as a mask for forming the contact through hole, thereby achieving a higher aperture ratio and better display quality than that of embodiment 1.

The conventional systems, such as those discussed below and in the Related Art section of the present application, do not have such a structure, and fail to provide for such an operation.

Such combination of features, including the first predetermined thickness being approximately 1.2 μm, the second predetermined thickness being less than approximately 0.4 μm and the dimension of the contact hole of approximately 5 μm, is clearly not taught or suggested by the cited references.

II. THE PRIOR ART REJECTIONS

Claims 1, 4, and 5 are rejected as unpatentable over Zhong, further in view of Ohta. The Examiner concedes that Zhong fails to provide a passivation layer over the TFT. To overcome this deficiency, the Examiner relies upon Ohta and the description at lines 34-67 of

column 8, and, more specifically, upon the use of the passivation layer PSV1, which the Examiner alleges would provide the motivation to modify primary reference Zhong, since such modification would "... protect a back channel portion of the TFT and thereby stabilize a threshold voltage, Vth, without warping of the substrate caused by the stress of said passivation layer."

The Examiner, therefore, relies upon the description for PSV1, as contained in lines 42-49 of column 8.

However, Applicant submits that, because of its different purpose, the thickness range (e.g., 0.05 - 0.3 μm, line 41 of column 8) of this protective passivation layer PS1 in secondary reference Ohta would not provide the function described by the present invention. That is, in primary reference Zhong, the thickness of the color filter material 101 shown in Figure 6(c) above the gate address line 7 is described at lines 19-21 of column 7 as being in the range of 1.0-3.0 μm.

The thickness of the color filter above the contact hole 35 differs by the thickness of the gate insulating layer 21, which is described at lines 6-8 of column 12 as having thickness of 2,000 - 3,000 Å (e.g., 0.2 - 0.3 μm). Therefore, the thickness of the color filter material 101 above the contact hole 35 in Zhong becomes 0.7 - 2.8 μm.

If the passivation layer PS1 of secondary reference Ohta, having thickness of 0.05 - 0.3 μm, were to be added to the top of the TFT in Zhong, the color material would be reduced by this thickness, thereby providing a color material thickness of 0.4 - 2.75 μm above the TFT.

The present invention teaches a thickness of less than 0.4 μm for this color material thickness above the TFT, using passivation thickness of 0.3 μm, when the color filter material is 1.2 μm in the pixel area.

Therefore, even taking the best combinations of ranges in Zhong/Ohta, the result would still not satisfy the plain meaning of the claim language in dependent claim 24.

For this reason alone, the claimed invention described in at least claim 24 is fully patentable over the cited references.

Moreover, because of the different problems being addressed in the cited references from that of the present invention, Applicant submits that the Examiner would clearly be

using the claimed invention as a road map to arrive at the combination of elements defined in dependent claims 24, 25, and newly-added claim 27, including the introduction of secondary reference Sasaki to suggest a specific thickness of 1.2 μm.

However, Applicant also submits that the different purposes of the cited references also means that independent claim 1 is also allowable over these references, since none of these references suggest the problem being addressed by the present invention, let alone the solution defined in the claim.

Finally, it is noted that lines 51-55 of column 5 of primary reference Zhong state that a key benefit of its method is the reduction of manufacturing steps. Therefore, Applicant submits that the additional steps to add the passivation film PSV1 described in Ohta would defeat this stated purpose of reduction in steps, thereby again demonstrating improper hindsight.

III. FORMAL MATTERS AND CONCLUSION

In view of the foregoing, Applicant submits that claims 1, 4, 5, 24, 25, and 27 are patentably distinct over the prior art of record and are in condition for allowance. The Examiner is respectfully requested to pass the above application to issue at the earliest possible time.

Should the Examiner find the application to be other than in condition for allowance, the Examiner is requested to contact the undersigned at the local telephone number listed below to discuss any other changes deemed necessary in a telephonic or personal interview.

The Commissioner is hereby authorized to charge any deficiency in fees or to credit any overpayment in fees to Attorney's Deposit Account No. 50-0481.

Respectfully Submitted,

Date: 5/29/06

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CERTIFICATION OF TRANSMISSION

I certify that I transmitted via facsimile to (571) 273-8300/-2301 this Amendment under 37 CFR §1.116 to the USPTO and a courtesy copy to Examiner T. Rude on May 29, 2006.

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